

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

A NEW GENUS AND SPECIES OF CRAWFISH
FROM THE SOUTHEASTERN UNITED STATES
(DECAPODA, ASTACIDAE)¹

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Taxonomically, the crawfishes assigned to the North American genus *Cambarus* have been recognized as the most difficult of the Cambarine, and remarkable convergence of morphological form among them has caused students to make tenuous assignments of relationships. The new species described below has as its closest relatives the members of the *Cristatus* Section (Hobbs, 1955:98) of the genus *Cambarus*: *C. cristatus* Hobbs (1955:95), *C. prominens* Hobbs (1966:110) and *C. valleculus* Fitzpatrick (1967:163). Further, this new species provides information explaining the "distant relationships" (see below) of the members of the *Cristatus* Section to other members of *Cambarus*.

This new crawfish could, on the basis of gonopodal characters and those of the annulus ventralis, be assigned to the *Limosus* Section (Ortmann, 1905:108) of the genus *Orconectes*; however, it shares many more characters with the members of the *Cristatus* Section (Hobbs, 1955:98) of the genus *Cambarus*. Among these characters are the broad antennal scale, the short-fingered chela with a cristiform row of tubercles along the inner margin of the palm, and features of the carapace which do not exist in any member of the genus *Orconectes*. Only in the two members of the genus *Faxonella* (Creaser, 1933:21) and in the members of the *Barbatus* (Hobbs, 1942:35) and *Planirostris* (Penn, 1953:75)

¹ Supported in part by NSF Grant GB-4719 to the senior author.

Groups of the genus *Procambarus* is there a marked resemblance in the conformation of the carapace to that of this new species and other *Cristatus* Section crawfishes. The annulus ventralis, while unique, is within the limits of variability one might expect in the *Cristatus* Section. The most distinctive feature is the sternal modification of the first form male: the conspicuous heavily setiferous lateral lobes of the sternum at the bases of the third and fourth pereopods have been observed in no other members of the *Cambarinae* except in the three species that compose the *Cristatus* Section.

In some species of *Cambarus* (*C. striatus* Hay, 1902:437; *C. reduncus* Hobbs, 1956:61; and *C. floridanus* Hobbs, 1941: 114) the tips of the first pleopods are surrounded by a setiferous hood. This hood, however, has a different morphological source from the hood of *Cristatus* Section crawfishes. In all of these the terminal elements of the pleopod of first form males are relatively long and, in the absence of a sternal modification, would project beyond the ventral margin of the coxae of the pereopods. In *C. striatus*, *C. reduncus* and *C. floridanus* the median portion of the sternum is depressed, producing a cup-like depression in the third and fourth sternites and "flaring" lateral margins. The setiferous hood of these species arises principally from these lateral margins. On the other hand, in members of the *Cristatus* Section the sternites of the third and fourth pereopod segments produce, bilaterally, a longitudinal, submarginal ridge which forms a depression to receive the pleopods. The setiferous hood arises from these ridges and from the associated coxopodites. Thus, these modifications seem to be two different solutions to the same problem, with superficially similar end results.

The only true *Orconectes*-like characteristic of this new species is the relatively straight central projection of the first pleopod of the male. While the angle of the central projection to the main shaft of the appendage in two species of *Cambarus* [*C. obeyensis* Hobbs and Shoup (1947) and *C. pristinus* Hobbs (1965)] is much less than in more typical members of the genus, in neither is it less than 50 degrees. Furthermore, the central projection is slender and acuminate in *C. cristatus* and its three relatives, whereas, in *C. obeyensis*, *C.*

pristinus and their relatives, it is more blade-like and has a terminal notch. The latter two species, on the basis of several characteristics, are clearly related to the "bartonii complex" of the genus, rather than to the members of what has been designated the Cristatus Section. We believe that the gonopods of neither of these assemblages could be conceived to be of a type which was ancestral to the other and suggest that in Hobbs' (1967:11) diagram of relationships of related crawfishes, based on gonopodal characters, that the "Cristatus Section" diverged from the pro-*Orconectes* line between those branches leading to *Procambarus pecki* and pro-*Cambarus*.

The Cristatus Section, as previously recognized, exhibits several apparently primitive characteristics. In all crawfishes, a short, broad areola, such as is found in members of the Cristatus Section, is considered primitive. The movable annulus ventralis is found in the Cambarellinae, *Procambarus*, *Paracambarus*, *Troglocambarus*, a few *Cambarus* (but none so freely movable as *cristatus* and its relatives), and very primitive *Orconectes*. It is simple and in some respects resembles that of the primitive troglobitic *Orconectes*. The straight central projection of the new species and the relative slenderness of the appendage are also primitive characteristics.

Hobbs, in describing *C. cristatus*, was aware of the uniqueness of this group. He stated (1955:98): "*Cambarus cristatus* is not closely related to any described species of the genus." Neither Hobbs (1966:110) in his description of *C. prominens* nor Fitzpatrick (1967:163) in describing *C. valleculeus* modified this position. This conclusion suggested an independent origin of the Section, but not until the discovery of the new species described below with its primitive gonopod could this be reasonably documented.

The angular reflection of the central projection in previously described species of the Cristatus Section crawfishes, then, represents a convergence (parallelism) in this characteristic in the Cristatus Section and other members now assigned to the genus *Cambarus*. Although this is the first recorded incidence of parallelism in pleopod characteristics in Cambarinae crawfishes, other incidences of parallelism are known to occur. Hobbs (1942:25) discussed the parallels of mor-

phology in burrowing crawfishes in which the areola is long and extremely narrow or obliterated and the rostral, post-orbital and cervical spines are much reduced or absent. The carapace similarities between members of the *Barbatus* and *Planirostris* Groups of *Procambarus*, *Faxonella*, and the "Cristatus Section" are mentioned above. In all of these there is a reduction of marginal spines on the rostrum and a reduction of the acumen. The margins of the rostrum tend to be converging or clypeate in outline. The cervical spines are reduced or absent. The areola is moderately broad or broad. These similarities are, however, indicative of ecologic habit rather than evolutionary relationship. All generally occupy temporary bodies of water and seem to dig simple burrows when these waters dry. Interestingly, too, these species groups seem to be, generally, complimentary in distribution. The *Barbatus* and *Planirostris* Groups are distantly related members of the genus *Procambarus*. The two species of *Faxonella* are not closely related to any other crawfish. Fitzpatrick (1963:60) noted that no other crawfishes possess the markedly unequal terminal rami of the first pleopods. Further, only in *Faxonella* are the terminal elements bent mesiad. Although the tips of the central projections cross in *Cambarus dissitus* Penn (1955:13), the primary bend of the terminal elements is caudad and the mesial deflection is secondarily derived in what is clearly a close relative of *C. fodiens* Cottle (1863:217), *C. byersi* Hobbs (1941:118) and *C. hedgpethi* Hobbs (1948:224). As we have indicated above, the "Cristatus Section" is unique.

Most contemporary students of crawfish evolution accept the concept that a *Procambarus*-like population was ancestral to the modern *Cambarinae* genera. The recent genera, then, represent specializations from a basic stock. These ideas have been discussed by Hobbs (1940:55); furthermore, Hobbs (1967:2) has described a troglolithic species of the genus *Procambarus* from Alabama and has further discussed the origins of the generic stocks (pp. 8-15). The existence of two primitive *Cambarus*-like species groups, which are at best very distantly related, strongly suggests a dual emergence of the *Cambarus*-like characters from a *Procambarus-Orconectes* ancestral population. One of these groups is represented by

C. obeyensis, *C. pristinus* and their relatives, and the other by *C. cristatus* and its relatives. In light of this apparently diphyletic origin of the genus as presently recognized, we propose that a new genus be erected to receive the members of the *Cristatus* Section and the new species described below:

Hobbseus new genus

Diagnosis: Rostrum broadly subovate and subspatulate. Areola 2.6–7.5 times longer than wide and constituting 28.7–35.5 per cent of total length of carapace. Cervical spines or tubercles lacking; suborbital angle much reduced or absent. Antennal scale approximately one-half times as broad as long with lamellar portion considerably broader than thickened lateral portion. Sternum of first form male with conspicuous, ventrally projecting, setiferous prominences at bases of third and fourth pereiopods. Terminal elements of first pleopod of first form male almost straight or bent; if bent, mesial process slender and projecting caudad beyond central projection for considerable distance; central projection acute to subsetiform, without subterminal notch. Cephalic margin of annulus ventralis of female joined to sternum by flexible membrane.

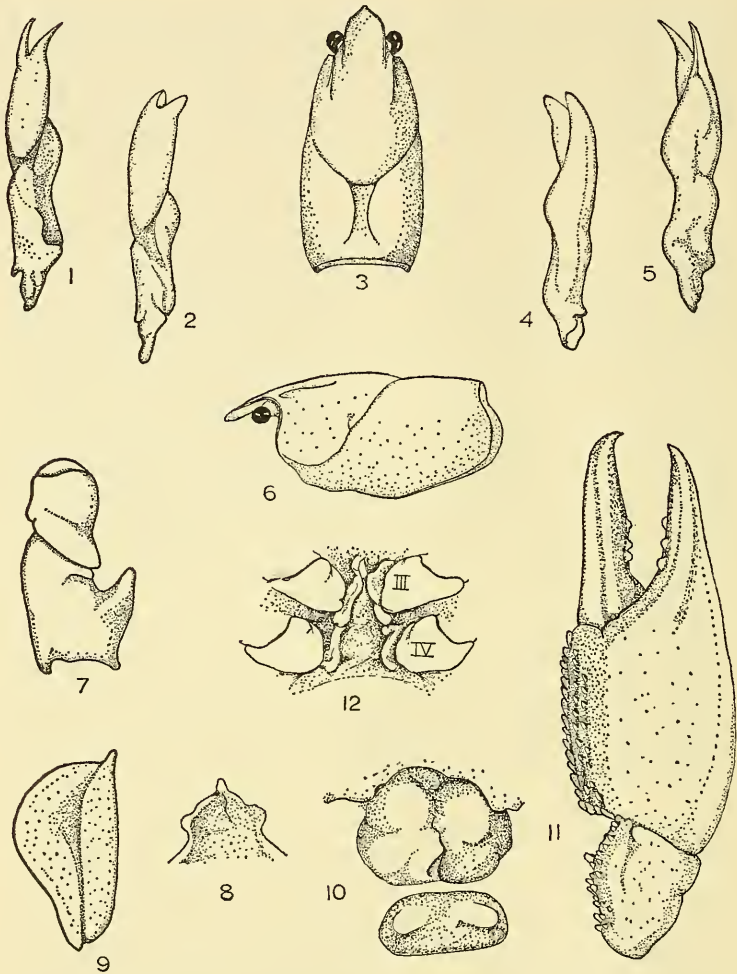
Type-species: Here designated. *Cambarus cristatus* Hobbs, 1955:95 (USNM no. 96985).

Etymology: We take pleasure in naming this new genus in honor of Dr. Horton H. Hobbs, Jr., in recognition of his efforts toward a better understanding of crawfishes.

Range: This genus is known only from the watershed of the Tombigbee River in Alabama and Mississippi and the upper portion of the Pearl River watershed in Mississippi.

KEY TO THE SPECIES OF THE GENUS *Hobbseus*

1. Central projection of first pleopod of first form male almost straight *H. orconectoides*, n. sp.
Central projection of first pleopod of first form males bent 2
2. Central projection bent at angle of 90° or less to axis of main shaft of appendages *H. cristatus* (Hobbs, 1955:95)
Central projection bent at angle greater than 90° to axis of main shaft of appendage 3
3. Central projection bent at approximately 110° angle to main shaft of appendage; mesial process extending approximately 1/3 its length beyond tip of central projection; pleopods symmetrical *H. prominens* (Hobbs, 1966:110)
Central projection bent at approximately 120° angle to main shaft of appendage; mesial process extending approximately 1/2 its length beyond tip of central projection; pleopods asymmetrical *H. valleculus* (Fitzpatrick, 1967:163)



FIGS. 1-12. *Hobbseus orconectoides*. (1) Mesial view of first pleopod of holotype; (2) mesial view of first pleopod of morphotype; (3) dorsal view of carapace of holotype; (4) lateral view of first pleopod of morphotype; (5) lateral view of first pleopod of holotype; (6) lateral view of carapace of holotype; (7) ischiopodite and basipodite of third pereiopod of holotype; (8) epistoma of holotype; (9) antennal scale of holotype; (10) annulus ventralis of allotype (sperm plug not illustrated); (11) distal podomeres of cheliped of holotype; (12) sternal processes and basal podomeres of third (III) and fourth (IV) pereiopods of paratype male, Form I. (Punctations and setation omitted from all figures.)

Hobbseus orconectoides new species

Diagnosis: Pigmented, eyes normal. Rostrum subplane or slightly excavate, subspatulate without marginal spines or tubercles. Areola 2.64–4.72 (avg. 3.54) times longer than wide, constituting 28.9–33.8 (avg. 31.9) per cent of entire carapace length. Suborbital angle obsolete. Antennal scale more than one-half as broad as long, lamellar portion widest distal to mid-length. Chela with row of cristiform tubercles along inner margin of palm. First pleopod of male with central projection almost straight, slender with acute tip; mesial process slender, distal half directed at about 45 degree angle to main shaft of appendage; mesial process extending distad beyond tip of central projection. First form male with conspicuous setiferous lateral lobes on sternum at bases of third and fourth pereopods. Pleopods symmetrical. Annulus ventralis (Fig. 10) freely movable; subovate; depression in cephalomedian portion of cephalic third; sinus arising in caudal portion of depression, moving sinuously caudad, disappearing near caudal margin.

Holotypic male, Form I: Body subovate, compressed laterally. Abdomen narrower than cephalothorax (8.1 and 9.0 mm, respectively). Width of carapace less than depth in region of caudodorsal margin of cervical groove (9.0 and 9.5 mm). Areola moderately broad (4.0 times longer than wide), with irregular row of punctations mesial to each branchiocardiac groove and irregular median longitudinal row, only three punctations across narrowest part. Cephalic section of carapace 2.2 times as long as areola; areola 31.2 per cent of total length of carapace. Rostrum 1.3 times longer than wide, subspatulate, with tiny acute acumen, but lacking marginal spines, tubercles or angles, margins not thickened and only slightly elevated; tip of rostrum reaching tip of distal end of peduncle of antennule; upper surface slightly excavate, with few setiferous punctations; rostrum depressed cephalically (Fig. 6). Subrostral ridges weak, barely evident in dorsal aspect.

Postorbital ridges well developed; cephalic ends lacking tubercles or spines. Suborbital angle obsolete. Branchiostegal spine small, but acute. Cervical tubercle nearly obsolete. Carapace moderately punctate dorsally and cephalolaterally. Abdomen longer than carapace (23.1; 20.5 mm). Cephalic section of telson with two acute spines in each caudolateral corner.

Epistoma (Fig. 8) broader than long, subplane with elongate cephalomedian tubercular projection. Antennules normal with small spine on lower surface of basal segment. Antennae broken. Antennal scale (Fig. 9) broadest distal to midlength, 1.91 times longer than wide, terminating distally in strong spine.

Chela (Fig. 11) with palm broad, only slightly inflated and somewhat depressed, length of inner margin of palm equal to width; upper surface of palm with prominent scattered squamous setiferous tubercles on inner half, tubercles becoming two rows just above inner margin, remainder of upper surface with less prominent tubercles; inner margin with single

crisiform row of 18 closely placed tubercles; lower surface punctate, fingers not gaping; upper and lower surfaces of both fingers with submedian ridge flanked by setiferous punctations; tubercle on lower surface at base of dactyl lacking; opposable margin of movable finger with four subequal tubercles along proximal two-thirds, and crowded minute denticles along distal one-third; opposable margin of immovable finger with one small, two large and one yet larger tubercle (proximal to distal) along proximal two-thirds and crowded minute denticles along distal one-third.

Carpus of cheliped longer than broad; grooved dorsally, with scattered setiferous punctations, inner margin with numerous prominent crisiform tubercles and one strong spine located on ventromedian margin at distal two-thirds of its length; lower surface with strong acute spine on cephalolateral margin. Upper surface of merus with row of five small squamous tubercles along distal one-half and two acute spines on distal margin; lower surface with row of 12 small subacute spines along mesial margin and row of 12 small subacute spines along lateral margin, strong acute spine in distal lateral corner and submedian row of three small acute spines in distal one-tenth. Ischiopodite with row of five small crisiform tubercles on inner margin.

Maxillipeds and coxae of third through fifth pereopods heavily setose.

Ischiopodites of third pereopods with strong simple hooks; hooks extending proximally beyond bases of ischiopodites (Fig. 7). Prominent setiferous projections at bases of third and fourth pereopods (Fig. 12).

First pleopods reaching to coxopodites of third pereopods when abdomen flexed, lying deeply embedded between ventrally projecting sternal projections; distal portion terminating in two parts; central projection comeous, tip acute, slender, nearly straight; mesial process noncomeous, slender, tapering from base to tip, distal half directed caudad approximately 45 degrees, extending beyond tip of central projection (Figs. 1, 5).

Morphotypic male, Form II: Differs from holotype in following respects: width of palm greater than length of inner margin; setiferous tubercles of upper surface of palm less prominent; tubercles along opposable margins of both fingers very weakly developed. Ischiopodite of third pereopod lacking hooks. First pleopod with both tips noncomeous, stouter, shorter, and more blunt (Figs. 2, 4).

Allotypic female: Differs from holotype in following respects: width of palm less than length of inner margin; inner margin of palm with single crisiform row of 12 closely placed tubercles along proximal two-thirds, row of three squamous tubercles along distal one-third; setiferous squamous tubercles of upper surface of palm less prominent; tubercles of opposable margins of both fingers less prominent.

Annulus ventralis freely movable, subovate; depression in cephalo-median portion of cephalic third; sinus originating at caudal margin of depression and moving sinuously caudad to disappear near caudal margin (Fig. 10). Sperm plug in cephalic portion of sinus (not figured).

TABLE 1. MEASUREMENTS (in mm)

	Holotype	Allotype	Morphotype
Carapace			
Height	9.5	9.3	8.2
Width	9.0	8.6	7.6
Length	20.5	18.8	18.8
Areola			
Length	6.4	6.4	6.1
Width	1.6	1.5	1.7
Rostrum			
Length	5.5	5.0	5.7
Width	4.4	4.1	4.3
Chela			
Palm length (inner margin)	7.5	4.2	5.4
Palm width	7.5	4.5	4.4
Palm length (outer margin)	15.7	9.2	11.9
Dactyl length	8.2	5.5	6.5

Type locality: Woodland pond near Rock Hill community, about 4¼ mi. N of Starkville, Oktibbeha County, Mississippi (R14E, T19N, Sec. 1). The pond is approximately 9 ft. deep, but *H. orconectoides* is found only along the shore, usually associated with emergent vegetation and shallow water.

Etymology: The trivial name of this species refers to the superficial resemblance of the gonopod and annulus to members of the genus *Orconectes*.

Disposition of types: The holotype, allotype and morphotype are deposited in the United States National Museum (nos. 129191, 129193, and 129194, respectively). Most of the remaining specimens are topoparatypes which are located at the USNM (2♂♂I, including the figured paratype; 1♂II, 1♀; 1♂j; 1♀j) the Museum of Comparative Zoology (2♂♂I; 3♂♂II; 5♀♀; 5♂♂j; 5♀♀j), Tulane University (2♂♂I; 3♂♂II; 5♀♀; 5♂♂j; 5♀♀j), the Ohio State Museum (2♂♂I; 3♂♂II; 5♀♀; 5♂♂j; 5♀♀j), and Mississippi State University (13♂♂I; 32♂♂II; 39♀♀; 45♂♂j; 46♀♀j; and 38 unsexed juveniles). Other paratypes are located at Mississippi State University (1♂II; 2♀♀; 1♂j). The type series represents collections from September through May in various years (1915–1967). None were collected in summer months. Presumably they burrow during the dry summer months. A collection from a burrow was made on 6 May 1967 at Rock Hill.

Variations: Very slight variation, almost exclusively in spinose and tubercular ornamentation of the cheliped, was observed. All are within the limits set by the types.

Relationships: These are discussed in preceding paragraphs.

Associates: At the type locality, other crawfishes present are *P. hayi* (Faxon, 1884:108) and *O. mississippiensis* (Faxon, 1884:123). At other places *P. acutissimus* (Girard, 1852:91) and *C. hedgpethi* Hobbs inhabit the same area.

Remarks on Range: *H. orconectoides* is never abundant and is moderately plentiful only at or very near the type locality. Diligent search has not located this species outside the watershed of Sand Creek, a small creek system confined to Oktibbeha County, Mississippi, and an effluent to Catalpa Creek which flows into Tibbie Creek. The latter forms the boundary between Clay and Lowndes Counties, west of the Tombigbee River. Such a restricted range is compatible with the primitive status which we propose for this species.

Acknowledgments: We are grateful to Messrs. James P. Thaxton and Houston F. Lowery who helped with collections and Dr. Horton H. Hobbs, Jr., for his critical evaluation of our ideas of the relationships of this species.

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